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ABSTRACT

The status of Arizona's effort to encourage the creation and expansion of high technology based on the discoveries and new knowledge developed at its research universities is discussed. The study of the University of Arizona and Arizona State University was recommended by the Arizona Board of Regents' Task Force on Excellence, Efficiency and Competitiveness. The application of academic research results to economic development is termed technology transfer. There are often concerns that a university engaging in technology transfer may experience a distortion or devaluation of its main mission, i.e., education and scholarship. This distortion need not occur if the academic community has appropriate administrative mechanisms in place. University technology transfer programs are explained, focusing on each university. The Arizona State University Research Park 5-year plan will contribute, it is hoped, to economic development in Arizona. Faculty and state participation in technology transfer are noted. Currently, most of the elements of a technology transfer program are in place in Arizona, but the program is very new and needs to mature. Five recommendations include: The Arizona Board of Regents and universities should streamline their procedures to be more responsive to faculty concerns and to develop greater faculty participation in technology transfer activities; both universities should evaluate their participation in private incubator organizations; and the Board of Regents should issue a formal statement on technology transfer which is less obtuse than its formal recommendations. (SM)

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TECHNOLOGY TRANSFER AND ECONOMIC DEVELOPMENT IN ARIZONA

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JAMES BROPHY

INTRODUCTION

It is conventional wisdom that national and regional economic growth can proceed from new technologies arising from academic research. Indeed, the nation's competitive position in international markets in today's world is viewed as dependent upon technological creativity and ingenuity stemming from the nation's universities. There exits ample evidence that economic development as measured in terms of new jobs and increased taxes is heavily dependent upon the creation of new businesses and the expansion of small businesses as distinct from the activities of major corporations, although the latter clearly continue to be important. Many states have instituted special programs to encourage the creation and expansion of high technology industry in their regions based on the discoveries and new knowledge developed at their research universities. This report describes the status of this effort in Arizona and suggests opportunities for improvement.

TECHNOLOGY TRANSFER

The application of academic research results to economic development has come to be termed "technology transfer," suggesting the movement of new information and ideas from the academic arena to the corporate world. The phrase really has a much broader meaning because the main mission of research university education and scholarship is clearly a direct application of technology as graduates take new knowledge with them into society. For present purposes, technology transfer is taken to be the process by which academic research results are commercialized through licensing and the formation of new businesses. The success of state and university technology transfer programs can be measured in part by the number of new jobs created and the magnitude of additional tax revenues generated. When put in these terms, concerns are often expressed that a university engaging in technology transfer may experience a distortion or devaluation of its main mission, education and scholarship. Clearly, this need not be so if the academic community has appropriate administrative mechanisms in place, for threats to the academic enterprise come from other directions as well.

TASK FORCE STUDY

This study results from an invitation from the Arizona Board of Regents Task Force on Excellence, Efficiency and

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Competitiveness to examine the technology transfer effort in Arizona. This includes reviewing the statistics and character of the academic research programs at the University of Arizona and Arizona State University, examining written patent and conflict-of-interest policies, and understanding the technology transfer structure at both institutions. In addition, personal interviews with 69 faculty and staff members at UA, ASU, and the Board of Regents were conducted over a period of four days.

UNIVERSITY TECHNOLOGY TRANSFER PROGRAMS

Administrative offices, policies and procedures for technology transfer are in place at both universities, and the academic research programs are sufficiently robust to serve as a source of many new technologies. Patent and copyright policies and conflict-of-interest and commitment policies at both universities stem from those of the Arizona Board of Regents. As might be expected, the UA technology transfer activity is larger than that at ASU because of the relative sizes of the academic research programs.

UNIVERSITY OF ARIZONA

The academic research program of the University of Arizona exceeds $100 million annually, placing it among the top 20 research universities in the nation. About 70% of the funding comes from federal agencies, principally the National Institutes of Health, the National Aeronautics and Space Administration, the Department of Defense, and the National Science Foundation. These agencies support Research in disciplines in which new discoveries appropriate for commercialization can be expected.

Technology transfer activities are centered in the two year old Technology Transfer Office which consists of one professional person reporting to the Vice President for Research. The major function of the office is to receive invention disclosures or other information from faculty members and to determine if and how to pursue licensing or other commercialization of the technology. It appears that such decisions are made with attention to the advice and wishes of the inventor/faculty member, which is important and appropriate. The Technology Transfer Office publishes a periodic newsletter to inform faculty and others about the program and to encourage faculty participation.

If the decision is made to market an invention by licensing, the Technology Transfer Office usually refers it to Research Corporation Technologies, Inc., a patent management firm, although occasionally a license is negotiated directly from the TT office. Funding considerations generally favor the former approach.

The University of Arizona has helped organize the Arizona Technology Development Corporation, a separate, for-profit company that nurtures start-up companies created to commercialize technology stemming principally from the UA academic research program. To date, six companies have been started and ATDC holds an equity position in each on behalf of the University. ATDC provides pre-venture capital funding, helps with preparing business plans, and places an ATDC officer on the board of each company to provide managerial advice, all of which are very necessary to a beginning company.

At the moment, ATDC is somewhat of a hybrid organization, being for-profit and

directly engaged in the operation of private businesses, yet with officers who are UA employees. This may have been the best way to initiate the activity, but it would seem prudent to increase the corporate separation between ATDC and UA so that the University is not viewed as operating in the private sector. Operating expenses and pre-venture capital funds for ATDC come from the University of Arizona Foundation.

ARIZONA STATE UNIVERSITY

In 1987 ASU received $39.2 million in research awards and contracts, placing it in the top 100 research universities in the country. Major federal funding agencies are the Department of Defense, and the National Aeronautics and Space Administration. Federal funding accounts for about 70% of the total effort. Here again, the agency disciplines are those which can be expected to offer opportunities for commercialization.

The Industry Liaison Officer in the Office of the Vice President for Research is charged with the technology transfer program, in addition to other activities involving university/industry interactions. New technology disclosures submitted by the faculty are evaluated with the advice of a patent attorney. The Industry Liaison Officer markets licensing opportunities directly, but also uses the services of Research Corporation Technologies, Inc. where this is appropriate.

The technology transfer program at ASU has not yet participated in a start-up activity, but the creation of a separate, for-profit incubator company is being discussed by members of the Hahn Center for Entrepreneurship and Innovation in the College of Business. Funding from the Arizona State University Foundation is anticipated. ASU has also organized the Arizona State Research Institute(ASRI), a non-profit corporation designed to act somewhat in the nature of an engineering experiment station which makes laboratory facilities and faculty expertise available to local small businesses in a more responsive way than the conventional corporate sponsored research program. Another stated purpose of ASRI is to help start new companies, but little attention has been devoted to this aspect to date.

Apart from the fact that appropriate administrative policies and practices are in place for technology transfer on both campuses, the most cogent statement that can be made is that both programs are new and have not yet had time to mature. A beginning can be reckoned from the change in the patent policy of the Arizona Board of Regents in 1986. Therefore, there is not yet a general awareness on either campus that the Regents and the universities are interested in actively pursuing technology transfer in Arizona.

ARIZONA STATE UNIVERSITY RESEARCH PARK

The financial strictures under which the ASU Research Park operates are such that it can contribute only peripherally to the technology transfer effort. In order to meet fiscal demands, it is necessary for the director to concentrate on attracting existing, large organizations to the park, a difficult challenge in view of competition and the general business climate. The present plan to occupy some 135 acres in the next five years is ambitious but driven by necessity. In the meantime, the park finds it difficult to perform an incubator function for small businesses or to provide expansion space for the crowded ASU academic

research program. If the director successfully accomplishes the five year plan, however, the park will contribute substantially to economic development in Arizona.

FACULTY PARTICIPATION IN TECHNOLOGY TRANSFER

Senior faculty members on both campuses feel that their universities have had little experience in technology transfer and that the effort may be too small to be effective. Actually, the level of awareness about the programs is low, but those faculty members who have had some involvement complain that the administration is inflexible and unresponsive to their ideas and that there are "negative incentives" to participation in terms of time demands and exposure to criticisms.

While such comments are somewhat indigenous to the nature of the activity, the negative attitudes are confirmed by the small number of invention disclosures received by both technology transfer offices. The numbers are well below those expected from the size of the academic research efforts at both institutions. The UA has experienced a significant increase in the number of disclosures during the first quarter of this year compared to previous years, which may mean that faculty attitudes are changing.

Faculty attitude problems are being addressed. For example, the new patent policy provides for quite generous royalty sharing. Additional publicity might be given to successful faculty role models in some of the 32 companies UA lists as arising from faculty research interests. Clearly, it is important for the faculty to be comfortable with the technology transfer program for, although less than one percent of the faculty is ever likely to be involved, the academic research program is the wellspring of the technologies that are candidates for commercialization.

Junior faculty on both campuses are basically unaware of the technology transfer efforts. This is appropriate, because younger faculty members need to concentrate on their academic career paths.

Faculty committees, the Technology Transfer Committee at UA and the Patent and Copyright Committee at ASU, monitor patent and conflict-of-interest policies on each campus. These appear adequate to deal with any potential abuses that may arise.

STATE PARTICIPATION

State agencies have an important role to play in technology transfer. The Regents can foster a positive technology transfer climate by minimizing review and approval procedures and promulgating statements and regulations that reduce faculty perception of risk.

It is possible to increase the size of the faculty research effort in those technologies deemed to be suitable for economic development in Arizona by instituting a modest state-supported matching grants program. By requiring two or three matching dollars for every dollar of state funding, Arizona can leverage federal and corporate research that is focused on Arizona interests. A larger research effort in these areas increases the possibility of developing technologies appropriate for commercialization in Arizona.

Such state matching grant programs are most properly placed in the state agency

responsible for economic development or in an organization especially created for the purpose, rather than in the Board of Regents. This makes is clear that the purpose of the activity is economic development and not additional state support for higher education. Also, the Board is not placed in the position of appearing to actively sponsor commercialization efforts at the research universities.

One of the major hurdles facing start-up companies is pre-venture capital funding. Currently, early stage funding can be provided from ATDC sources and the incubator facility being organized at ASU, but this is hardly sufficient. A state program to invest in new ventures which would help attract venture capital is highly desirable. A convenient source of such funds may be the state pension fund.

SUMMARY

Most of the elements of a technology transfer program in Arizona are in place. The formal program is very new, however, and while there have been some early successes, the effort needs adjusting and maturing. In particular, greater faculty awareness and support needs to be developed and the Regents should foster a more entrepreneurial climate.

RECOMMENDATIONS

The following are some specific recommendations:

- The Arizona Board of Regents and the universities should streamline their procedures in order to be more responsive to faculty concerns and to develop greater faculty participation in technology transfer activities.
- Both universities should evaluate their participation in private incubator organizations.
- Arizona should consider instituting a matching grants program to increase the academic research effort in those disciplines important to economic development in the state.
- Arizona should consider creating a pre-venture capital fund to assist in the early stages of start-up company development and expansion.
- The Arizona Board of Regents should issue a formal statement on technology transfer which is less obtuse than the formal regulations.